AMENDMENTS TO THE DRAWINGS

Entry of the attached eight (8) sheets of drawings is requested, in place of the eight (8) sheets of drawings contained in the PTO IFW indexed at July 28, 2006, as originally-filed with the application. The originally-filed eight (8) sheets of drawings contain English language text. The attached Replacement Sheets of drawings are not being filed with a corresponding set of Annotated Sheets as no changes have been made in the attached as compared with the originally-filed drawings. No new matter has been added.

REMARKS

Reconsideration is requested.

Claims 1-17 are pending. Claims 13-17 have been added and find support in the specification and originally-filed claims. No new matter has been added.

Entry of the attached eight (8) sheets of drawings is requested, in place of the eight (8) sheets of drawings contained in the PTO IFW indexed at July 28, 2006, as originally-filed with the application. The originally-filed eight (8) sheets of drawings contain English language text. The attached Replacement Sheets of drawings are not being filed with a corresponding set of Annotated Sheets as no changes have been made in the attached as compared with the originally-filed drawings. No new matter has been added. The Examiner is requested to contact the undersigned in the event anything further is required with regard to the figures.

Withdrawal of the objection to the drawings is requested.

The claims have been revised, without prejudice, to obviate the Section 112, second paragraph, rejection of claims 1 and 5. Withdrawal of the rejection is requested.

The Section 102 rejection of claims 1-7 and 11-12 over Ma (Catalytic Growth of Carbon Nanofibers on a Porous Carbon Nanotubes Substrate, Journal of Material Science Letters 2000; 19:1329-1931), is obviated by the above amendments. Reconsideration and withdrawal of the rejection are requested in view of the above and the following comments.

The applicants submit that Ma teaches a process for obtaining carbon nanofibers bound to porous carbon nanotubes as substrate, wherein the process is understood by

the applicants to involve immersing the substrate (porous block-type carbon nanotubes pellets) in an aqueous solution of catalyst (nickelous nitrate) for a whole day. (See page 1929, col. 1, lines 33-36); taking out the aqueous solution of catalyst and drying the substrate; contacting the dried substrate with mixed gases (C_3H_6 as carbon source compound and H_2) at a temperature of 750°C. (See page 1929, col. 2 – page 1930, col. 1).

The process according to the cited art involves the formation of nanofibers on a already existent substrate of carbon nanotubes. In contrast, the claimed process involves the formation of carbon nanotubes on a support of ceramic or carbon fiber.

Moreover, the process of the cited art involves a catalyst contacted with the substrate before it is contacted with the carbon source compound (C_3H_6 in a gaseous state).

In contrast, in the claimed process, the support is contacted with a mixture of a carbon source compound and a catalyst into a stream of inert gas and hydrogen (i.e. the support comes into contact with the catalyst at the same time as the carbon source compound).

Withdrawal of the Section 102 rejection is therefore requested as the cited art fails to literally or inherently describe each and every aspect of the claimed invention.

The applicants submit that the claimed process presents the following advantages: (1) the claimed process involves simultaneously contacting the support with the catalyst and the carbon source compound in contrast to Ma's process which involves first depositing the catalyst on the pellet support (by impregnating the substrate

with a catalyst (nickelous nitrate), drying it and reducing the H2), and (2) the claimed process does not require a long period of contact between the catalyst and the supports. The presently claimed method therefore includes a simultaneous contact process in contrast to Ma's process which involves several steps of drying and reduction after a long period of impregnation. Moreover, the claimed process is advantageous in that the claimed process does not require a long period of contact between the catalyst and the supports. As a result, the claimed process allows minimization of deterioration of intrinsic properties of the support by avoiding diffusion of elements of the catalyst in the matrix of the support and to minimize contamination of the catalyst by reducing diffusion of elements of the support in the catalyst.

Further, the applicants believe that the substrate used in the process of the cited art has a dimension of 10mm x 10mm x 1mm (page 1929, col.2, lines 3-5), which is not believed to be a nanometric and/or micrometric-sized support in contrast to the support required by the claimed process.

These distinguishing features of the claimed process allow to control the growth of the carbon nanotubes on the surface of the support and to uniformly cover the support (see paragraph [0026] of the USPTO published version of the specification). In addition, the claimed process allows the preparation of carbon nanotubes/support reinforcing material, which when incorporated into a matrix (e.g., a polymer, ceramic or metal matrix), makes it possible to (a) reinforce the matrix close to the interface (conventional reinforcements/matrix interface); (b) improve the adhesion between conventional reinforcements and the matrix; (c) delay or prevent the initiation and

propagation of damage and/or cracking at the interface; and (d) reduce the difference (or the jump) in various properties between conventional reinforcements and the matrix, such as the thermal expansion coefficient and the mechanical properties, in order to prevent the generation of large residual stresses at the interface, especially during heat or mechanical cycles (see ¶[0030]-[0035] of the Patent Office published version of the present specification).

Hence, the claimed process allows the preparation of composite materials with enhanced reinforcing effects.

The applicants further submit, with regard to claims 11 and 12, that Ma describes carbon nanofibers bound to porous carbon nanotubes pellets as substrate. Furthermore, the applicants understand the supports to have dimensions of 10 mm x 10 mm x 1 mm (page 1929, col. 1, lines 39-42). However, Ma is not understood to disclose carbon nanotubes bonded to nanoscale/microscale carbon fiber or ceramic fiber support materials, much less multiscale composites formed therefrom. Furthermore, the applicants believe that the cited art fails to literally or inherently disclose carbon nanotubes bonded to nanoscale/microscale supports in a polymer, metal or ceramic matrix, much less multiscale composites comprising them.

Withdrawal of the Section 102 rejection is requested.

The Section 103 rejection of claims 1-10 over Rao (Material Research Innovation 1998; 2:128-141) in view of Ma (Journal of Materials Science 1998; 33: 5243-5246), and the Section 103 rejection of claims 2-4 and 9-10 over Rao in view of Wang (U.S. Patent Application Publication No. 2003/0119920), and the Section 103 rejection of claims 2-4

and 9-10 over Rao, Wang and Saitoh (U.S. Patent Application Publication No. 2006/0052509), are traversed. Reconsideration and withdrawal of the rejections are requested in view of the above and the following distinguishing comments.

The applicants understand Rao to describe a process for obtaining carbon nanotubes which involves heating an organometallic precursor to the temperature of 623K at a controlled heating rate in a first furnace, in order to sublime the organometallic precursor; carrying the metallocene vapour by a gas mixture of inert gas (argon), hydrogen and a source of carbon (benzene) into a second furnace; and maintaining the second furnace at 1173K in order to pyrolyse the resulting gas mixture. See page 132, col. 1, lines 1-14 of Rao. Rao therefore describes a process of preparing carbon nanotubes in a furnace and does not teach or suggest a process involving carbon nanotubes bound to a support.

The applicants believe that Rao does not describe or suggest a process for obtaining carbon nanotubes bound to supports. The applicants believe that Rao does not describe or suggest a process of the claims wherein a mixture of catalyst and carbon source compound are contacted with nanometric and/or micrometric-sized supports in a simultaneous fashion. The process of the claimed invention is demonstrated in this regard, for example, on page 9, lines 35-37 of the specification.

Moreover, the applicants believe that the process described by Rao requires several steps and requires an elaborate apparatus with two furnaces and temperature controllers (page 129, Fig. 1), in particular involving conditions that allow sublimation, which are not required by the claimed method.

In contrast, the claimed process leads to carbon nanotubes bound to supports with a uniform cover and to prepare composite materials with enhanced reinforcing effects (see paragraph [0026] and [0035]-[0035] of the USPTO published version of the specification). The claimed process also allows one to avoid important drawbacks associated with composites comprising conventional carbon nanotube reinforcements, such as (1) poor dispersion and/or destruction of the carbon nanotubes during dispersion, (2) weak interfacial properties between carbon nanotubes and the composite matrices, and (3) damage mechanisms due to stresses, and in particular caused by the difference in properties and thermal expansion coefficient between carbon nanotubes and the composite matrices (see ¶[0002] and [0003] of the Patent Office published version of the present specification).

Furthermore, the claimed process provides the advantage of reducing the step of contacting the support, the catalyst and the carbon source compound to a single step (i.e., the support is contacted simultaneously with the catalyst and carbon source compound).

Ma fails to cure the deficiencies of Rao.

The applicants understand Ma to describe a process for obtaining CNTs-SiC ceramics from carbon nanotubes sintered with an SiC powder material. The process of the cited Ma document involves producing carbon nanotubes by catalytic pyrolysis C_2H_4/H_2; dispersing the resulting carbon nanotubes with nanoparticles of silicon carbide powder (β-SiC) and microparticules of a sintering additive (B4C) in butylalcohol using an ultrasonic shaker; drying and breaking-up the mixed powders; and hot-pressing

(sintering) the powders at 2273K. <u>See</u> page 5243, point 2. “Experimental procedure”.

Thus, the applicants believe that the process of the cited Ma document relates to a sintering process (page 5245, col. 1, lines 1-2), or a process that involves the heating of a powder below its melting point until its particles adhere to each others. Specifically, the applicants believe that the cited Ma document only teaches that previously-obtained carbon nanotubes can be retained in SiC ceramic under specific hot-press conditions (page 5246, col. 1, lines 3-5). The carbon nanotubes are not grown on the SiC powder particles. The carbon nanotubes are first synthesized, and are then mixed and sintered with the SiC powder.

In addition, the applicants submit that Ma’s sintering process involves mixing/dispersing the carbon nanotubes with the SiC powder, which damages the carbon nanotubes (e.g., carbon nanotubes are shortened due to breakage, etc.). The claimed process avoids this drawback in that it allows the growth of the carbon nanotubes directly onto the support, thereby obviating the damages due to the dispersion. As damages to the carbon nanotubes are minimized, interfacial properties between the carbon nanotubes/support reinforcing material obtained by the claimed process and the composite matrices in which they are incorporated are enhanced, thereby leading to composite materials with enhanced reinforcing effects.

The cited Wang document fails to cure the deficiencies of Rao.

The applicants understand Wang to describe a process for obtaining a carbon nanotubes-containing structure which involves contacting a catalyst (seed particles) on a porous support material to form a seeded porous material, and then heating and

exposing the seeded support to a carbon source in a gaseous state to grow carbon nanotubes on the surface of the seeded support material (paragraphs [0013] and [0069]-[0072]). In particular, seed particles are metallic particles, for example iron particles, and serve as catalysts for nanotube growth (paragraph [0047]). The applicants also understand the cited Wang document to also disclose the use of ceramic, silica, alumina or silicon carbide as support materials (paragraph [0042]).

The applicants believe however that Wang does not disclose nor suggest a process whereby a mixture of the carbon source and catalyst are contacted with the support in a simultaneous fashion. Moreover, the applicants believe that Wang does not disclose nor suggest a process wherein the supports are nanometric and/or micrometric-sized.

The Wang reference fails to cure the deficiencies of Rao. The applicants believe that neither reference teaches or suggests a step of contacting a anometric/micrometric-sized support with a mixture of a carbon source compound and a catalyst.

The claims are submitted to be patentable over the combination of Wang and Rao.

Finally, the disclosure of Saitoh is not believed to cure the deficiencies of Wang and Rao.

The applicants understand Saitoh to describe a process for obtaining a composite which involves forming a carbon nanotube composition by irradiating with ultrasonic waves a mixture of a conducting polymer or a heterocyclic compound trimer, a solvent and carbon nanotubes; coating the carbon nanotube composition onto at least

one surface of a base material; and allowing to stand at an ordinary temperature or subjecting to heating treatment in order to form a coated film (paragraphs [0017] to [0019]). The applicants believe that Saitoh also discloses the use of a silane coupling agent in combination with the carbon nanotube composition to improve the moisture resistance of the resulting coated film (paragraph [0092]).

The applicants submit however that Saitoh does not disclose nor suggest a process whereby a mixture of the carbon source and catalyst are contacted with the support in a simultaneous fashion. Moreover, this document does not disclose nor suggest a process wherein the step of contacting is effected by chemical vapor deposition (CVD). Furthermore, this document does not disclose nor suggest a process wherein the supports are nanometric and/or micrometric-sized.

The Saitoh reference fails to cure the deficiencies of Rao and Wang as neither reference teaches or suggests, for example, a step of contacting a nanometric/micrometric-sized support with a mixture of a carbon source compound and a catalyst. Accordingly, the combination of cited art would not have made the claimed invention obvious.

Withdrawal of the Section 103 rejections is requested.

The claims are submitted to be in condition for allowance and a Notice to that effect is requested. The Examiner is requested to contact the undersigned, preferably by telephone, in the event anything further is required.

Respectfully submitted,

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